REMARKS/ARGUMENTS

Claims 1, 3, 5 and 7 are amended. New claims 8-12 are submitted with this response. Claims 1-12 remain in the application.

Applicant hereby requests further examination and reconsideration of the application in view of the foregoing amendments and discussion below.

Claim 1 is amended for clarification and to recite that the hollow shell member is a solid piece and that the second molten metal introduced into the shell member has a higher melting point than the metal comprising the shell member. Support for this amendment can be found, for example, at page 3, line 15, and page 3, line 21 to page 4, line 13, of the specification.

Claim 3 is objected to because of the phrase "a refractory a bottom" and is corrected herein.

Claim 5 is rejected under 35 U.S.C. §112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as their invention for use of the term "predetermined". Accordingly, this term is deleted by amendment herein.

Claim 7 is amended to correctly depend from claim 5.

Claim 8 is added depending from claim 1, and recites that the first metal forming the shell member is stainless steel. Support for claim 8 can be found, for example, at page 4, lines 10 and 11, of the specification.

Claim 9 is added depending from claim 1, and recites that the second metal forming the core member is carbon steel. Support for claim 9 can be found, for example, at page 4, lines 11-13, of the specification.

Claim 10 is added depending from claim 1, and defines a shell member having a thickness which is at least about 5% of the cross-sectional area of the workpiece. Support for claim 10 can be found, for example, at page 4, lines 22-24, of the specification.

Claim 11 is added depending from claim 5, and defines a clad metal article wherein the thickness of the first metal is at least about 0.005 inches. Support for claim 11 can be found, for example, at page 4, lines 24-26, of the specification.

Claim 12 is added depending from claim 5, and defines a rolling step wherein the reduction is at least about 120 to 1. Support for claim 12 can be found, for example, at page 6, lines 17-26, of the specification.

Claims 1 and 6 are rejected under 35 U.S.C. §102(b) as anticipated by U.S. Patent No. 4,901,906 to Kvavle; U.S. Patent No. 3,625,277 to Watts; or U.S. Patent No. 3,192,581 to Sylvester. The examiner states that each of these references discloses introducing molten metal into a shell of a different metal wherein a metallurgical bond is formed between the two metals.

The examiner cites Figures 1-14, column 4, lines 34-42, and column 6, lines 3-9 of Kvavle; Figures 1-5 and column 2, lines 35-63 of Watts; and Figures 1-4 and column 3, lines 25-72, of Sylvester.

The Applicants respectfully submit that claim 1, as amended herein, patentably distinguishes from the above references. Claim 1 now recites, *inter alia*, a step of providing a solid hollow shell of a first metal for receiving a molten second metal having a higher melting point than the first metal. These claimed features, with the advantages described in the specification, are neither taught nor suggested by references cited by the examiner.

Kvavle teaches a method of producing a composite metal article in which the metal comprising the core, aluminum, has a lower melting point than the metal comprising the shell stainless steel. (See Kvavle at column 2, lines 23-29 and 43-47, and column 3, lines 57-68). Since Kvavle fails to shows each and every element of the presently claimed invention, the Kvavle reference cannot anticipate claim 1.

Watts discloses a continuous casting process, including a tundish and a closed-end mold which is continuously moved away from the tundish during introduction of a molten shell metal followed by a core metal. The molten core metal then moves the molten shell metal toward the mold to form a continually elongating shell of a billet, with an area of liquid intermixing. (See Watts at column 2, lines 32-34, and Figure 2). The Applicants' claimed method begins with the step of providing a solid, hollow shell member of a first metal for receiving the molten second metal. There is no liquid-to-liquid contact in the method of the presently claimed invention as in Watts, which describes the area of liquid intermixing noted above. The Watts' shell begins as a liquid and is never hollow since the shell is always filled with either the molten shell metal or the molten core metal, or both.

Sylvester teaches a mold assembly positioned above two pressure pouring ladles containing molten stainless steel and molten carbon steel, respectively. The ladle containing the stainless steel is pressurized for filling the mold. After a period, the molten stainless steel is drained and the carbon steel ladle is pressurized for forcing the carbon steel up into the stainless steel lined mold. Sylvester does not use a solid, hollow shell member for receiving the molten second core metal as presently claimed. The Sylvester process includes the step of molding the stainless steel shell from molten metal and then adding molten core metal while in the mold. The Applicants identified the Sylvester method as prior art in the Background section of the present application. Specifically, such prior art methods include formation of composite ingots by casting a metal for an outer layer into a mold and allowing unsolidified metal to drain from the mold prior to addition of a molten core metal. However, considerable segregation of the metals occurs with this method. Moreover, this method is costly, inefficient and complex, as noted by Applicants in the Background of the specification. Claim 1 defines a clad billet produced in a single casting process which distinguishes over Sylvester.

Claims 1-2 and 6 are rejected under 35 U.S.C. §102(b) as being anticipated by Japanese Publication 60-244459 to Hanmiyo. The examiner states that Hanmiyo discloses introducing a metal core by bottom casting into a mold containing a shell of stainless steel, citing Figure 3 of Hanmiyo.

The Applicants respectfully submit that Claim 1, as amended herein, patentably distinguishes from Hanmiyo. Hanmiyo teaches installing what appears to be sheets of cladding metal to the inside of a casting mold. Hanmiyo is not unlike Sylvester in that a composite ingot is formed by casting in a mold. However, Hanmiyo uses separate sheets of cladding material which is significantly different than the Applicants' invention as defined in Claim 1, which recites providing a solid hollow metal shell of a first metal for receiving a second molten metal. This claim feature is not found in Hanmiyo.

Claims 1 and 6 are rejected under 35 U.S.C. §102(b) as anticipated by U.S Patent No. 3,274,681 to Lohman, and claims 5 and 7 are rejected under 35 U.S.C. §103(a) as being obvious over Lohman in view of U.S. Patent No. 2,464,163 to Weesner. The examiner states that Lohman discloses introducing molten metal into a shell of a different metal wherein a metallurgical bond is formed between the two metals and rolling the composite billet, citing Figures 1-4; column 2, lines 58-65; and column 3, lines 54-58. With respect to claims 5 and 7, the examiner correctly notes that Lohman does not disclose using heating operations to facilitate rolling operations for his carbon steel/stainless steel composite billets. The examiner relies on Weesner to show that when rolling such composite billets, it is normal practice in the art to use heating steps to facilitate the rolling operations, citing column 5, lines 24-50 of Weesner. The examiner concludes that claims 5 and 7 would have been obvious to one of ordinary skill in the art at the time the invention was made since to use heating operations to facilitate the rolling operations disclosed by Lohman is taught by Weesner as a "normal practice".

The Applicants respectfully submit that the present invention is not shown or suggested by Lohman, either alone or in combination with Weesner. Lohman discloses a method of forming a clad metal product using a pressurized tank housing a ladle of molten cladding metal. A pouring tube extends down into the cladding metal and outwardly through the cover of the tank. The outer end of the pouring tube is connected to a mold. Pressurizing the tank forces cladding metal through the pouring tube and up into the mold. The outer surface of the cladding metal freezes forming a shell. Core metal is then poured into the mold forcing the molten cladding metal down into the tank. The Lohman method is thus similar to Watts in that Lohman and Watts both teach liquid-to-liquid contact and an area of intermixing of molten cladding metal and molten core metal. (See Lohman at column 2, lines 60-72, and Fig. 2). As noted above, the Applicants' invention has no liquid-to-liquid contact since the claimed method requires a solid, hollow shell member for receiving the molten second metal. Thus, Lohman does not teach or suggest the presently claimed invention, either singly or taken in combination with Weesner.

Claims 1 and 5-7 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,537,808 to Yamamoto, and claims 1-7 are rejected under 35 U.S.C. §103(a) as being obvious over Yamamoto in view of U.S. Patent No. 5,207,776 to Pearce. The examiner states that Yamamoto discloses introducing molten metal into a shell of a different metal wherein a metallurgical bond is formed between the two metals during repeated rolling steps and heat treatments, citing column 2, lines 43-54 of the Yamamoto reference. With respect to his obviousness rejection, the examiner correctly notes that Yamamoto does not specify how the molten metal is cast into the shell. The examiner relies on Pearce for this deficiency, which discloses that it is now known in industry that bottom pouring should be used when pouring

molten metal into a mold. According to the examiner, Pearce also discloses that when using bottom pouring, it is preferred to use a refractory funnel for directing the molten metal and it is preferred to perform all operations under vacuum to prevent contamination and air inclusion. The examiner concludes that, in view of Pearce, it would have been obvious to one of ordinary skill in the art to use bottom pouring and vacuum processing to cast the composite article of Yamamoto because Pearce discloses that bottom pouring is now favored by the industry because it reduces defects and Pearce teaches that using vacuum processing for composite castings reduces the chance of contamination and air inclusion.

The Applicants respectfully submit that the present invention is not shown or suggested by Yamamoto, either alone or in combination with Pearce. Yamamoto relates to an electrically conductive spring material having a copper core and an iron- or nickel-based alloy clad material produced, in one embodiment, by pouring molten copper into a steel pipe. Copper has a lower melting point than steel. Thus, Yamamoto teaches a method different from Claim 1 which recites a solid hollow shell of a first metal for receiving a molten second metal having a higher melting point than the first metal. Therefore, Yamamoto fails to shows each and every element of the presently claimed invention and cannot anticipate claim 1. This deficiency cannot be cured by combining Yamamoto with Pearce.

Claims 2-12 of the present application all depend from claim 1. In addition to the distinguishing features recited in claim 1 and discussed above, the dependent claims of the present invention recite additional advantageous features which further distinguish the present invention over the prior art.

For the foregoing reasons, the Applicants respectfully submit that the method and product claimed in the present application are not anticipated nor fairly taught or suggested by any of the references cited by the Examiner, either alone or in any reasonable combination suggested by the prior art. Reconsideration and withdrawal of the rejections and allowance of claims 1-12 at an early date are respectfully requested.

If the Examiner has any questions about the present Amendment or anticipates finally rejecting any claim of the present application, a telephone interview is requested.

Respectfully submitted,
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